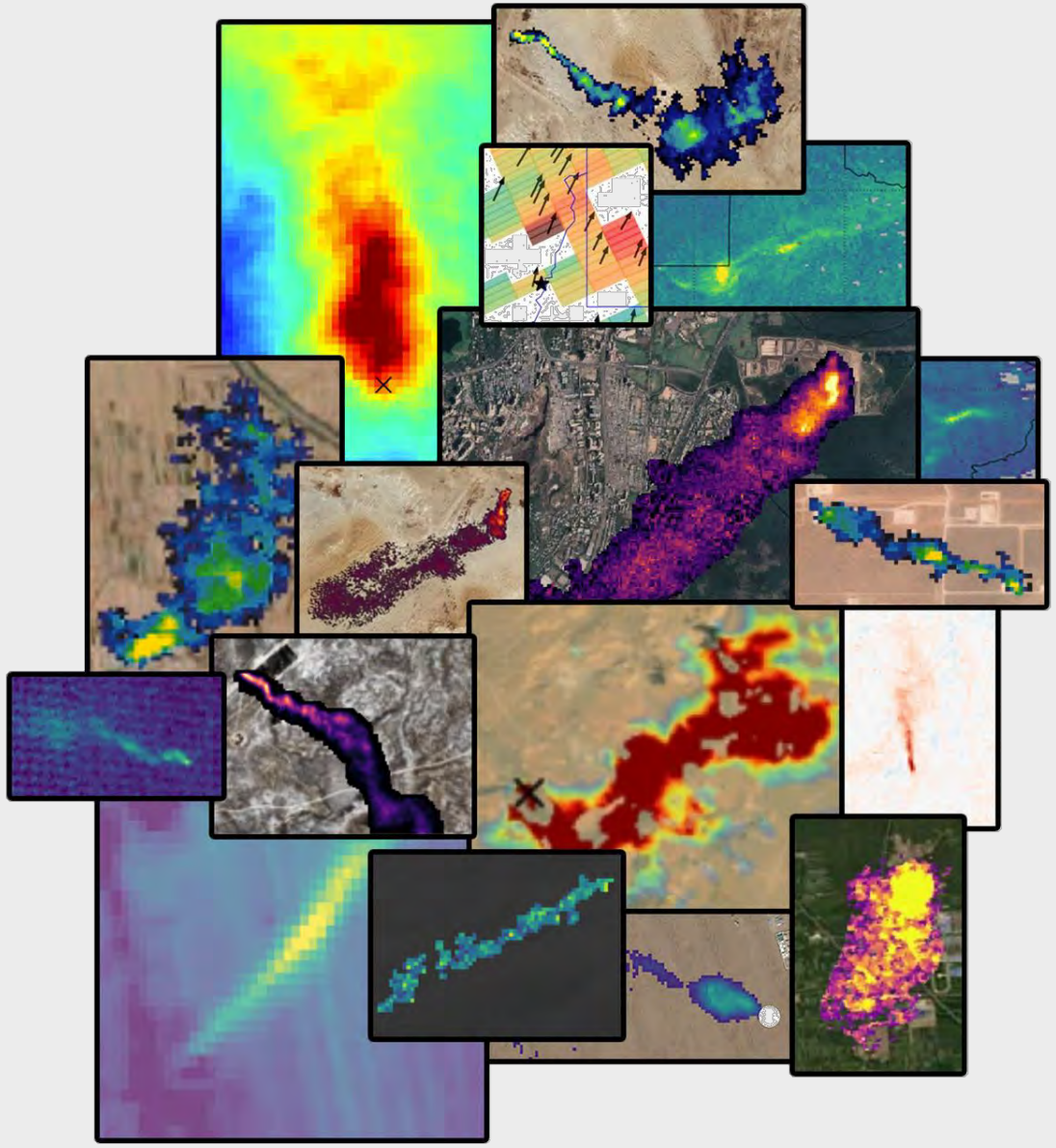
Methane
Emissions
Detection
Using
Satellites
Assessment

September 3, 2024



esa

SRON Netherlands Institute for Space Research

Universitat Politècnica de València

KAYRROS

GHGSAT

Universität Bremen Institut für Umweltphysik (IUP)

University of Leicester

Overview of satellites observing methane hot spots

Global flux mappers

Sentinel-5P
(TROPOMI)

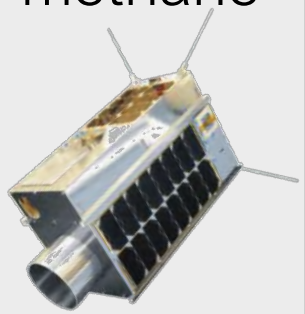
GOSAT-GW

Sentinel-5

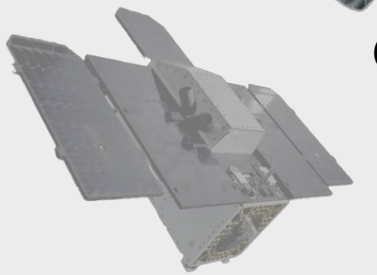
MethaneSAT

Point source imagers

Designed for methane

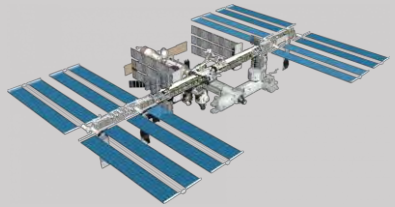


GHGSat

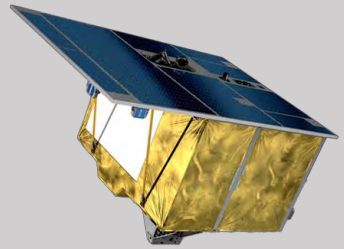


Carbon Mapper

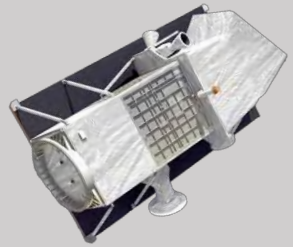
Hyperspectral



EMIT/ISS



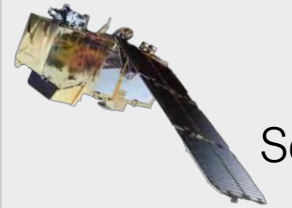
EnMAP



PRISMA

Band Imagers

Landsat



Sentinel-2

Sentinel-3

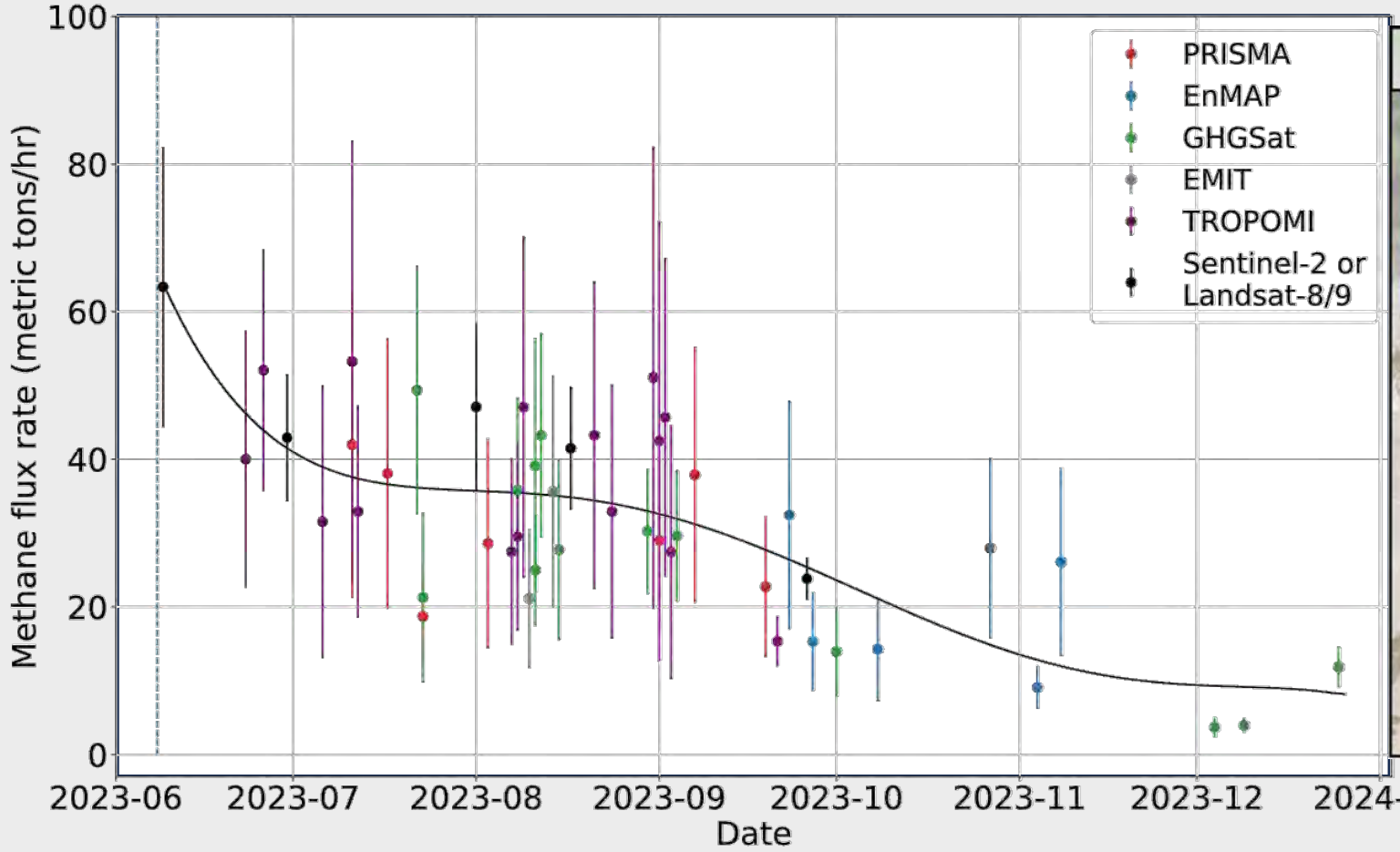
GOES

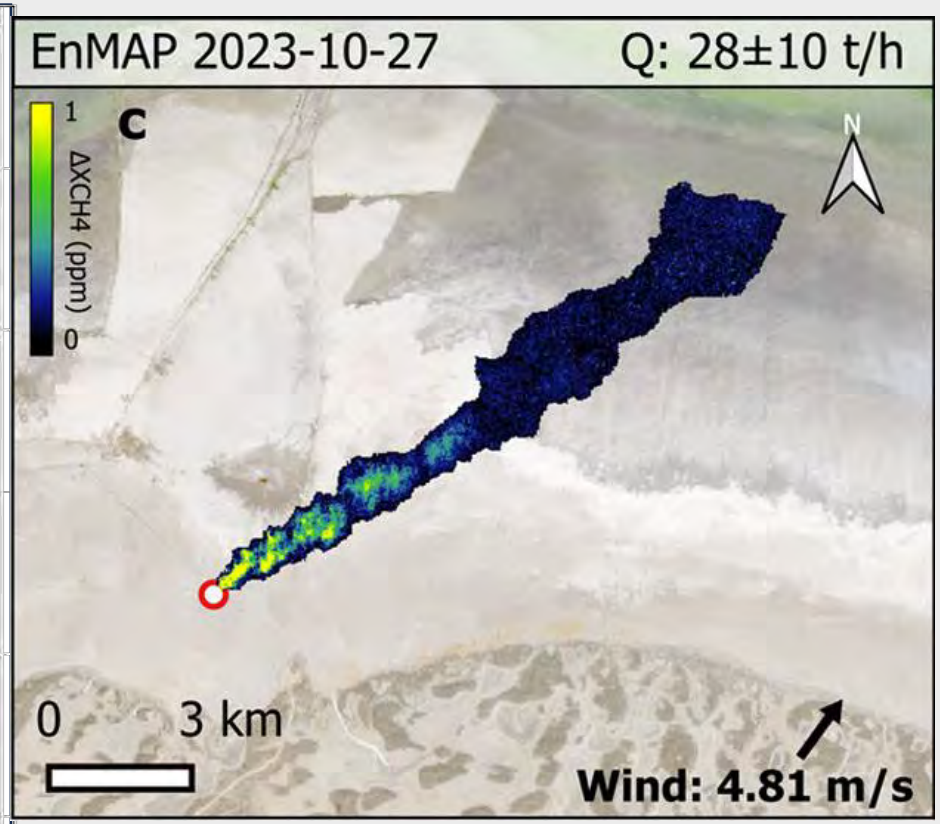
VIIRS

Animation Credit: ESA/ATG

MEDUSA – Objective

‘To develop the techniques and a pre-operational system to harmonize and integrate global information on subnational (urban, hot spot) to facility scale anthropogenic methane emissions derived using diverse satellite instruments and algorithms.’





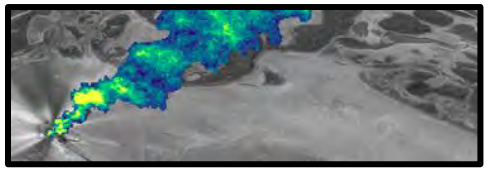
Guanter et al. (2024)

MEDUSA – Setup

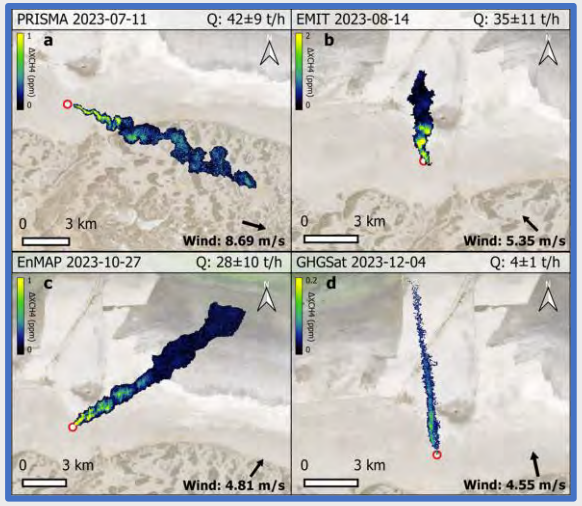
Bloomberg

Scientists Say They've Detected a Huge Methane Leak in Kazakhstan

Satellite imagery suggests large-scale release of the potent greenhouse gas, though the company developing the well claims it is mainly hot vapor.



High resolution instruments



Validation of high-resolution imagers against *controlled releases* (gold standard)

Slide Credit: Matthieu Dogniaux

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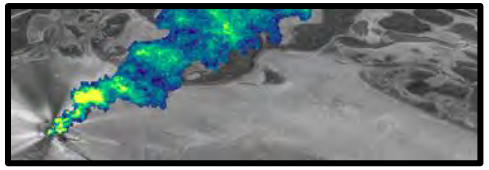

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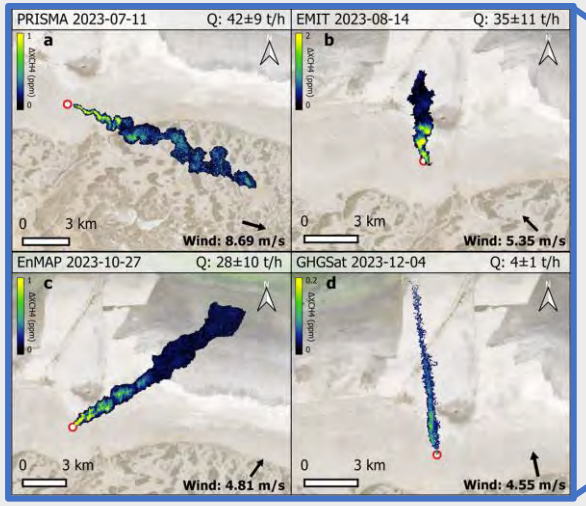
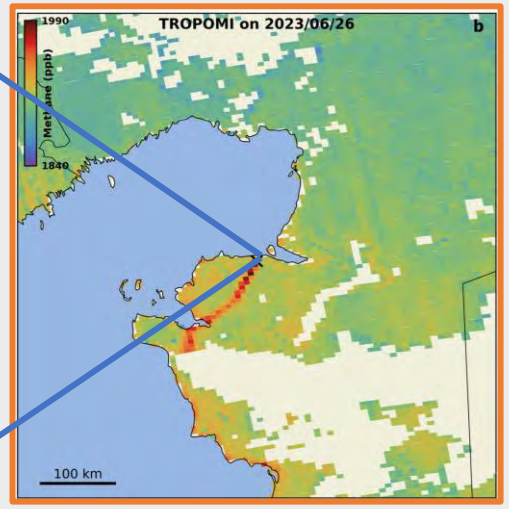


Coarse resolution instruments



Validation of high-resolution imagers against *controlled releases* (gold standard)

Linking coarse resolution mapper observations on relevant cases

1 Validation of emission estimates

Slide Credit: Matthieu Dogniaux

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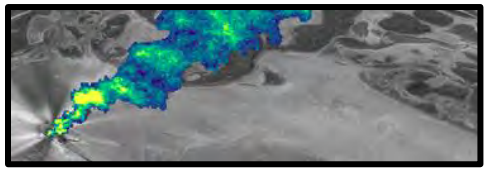
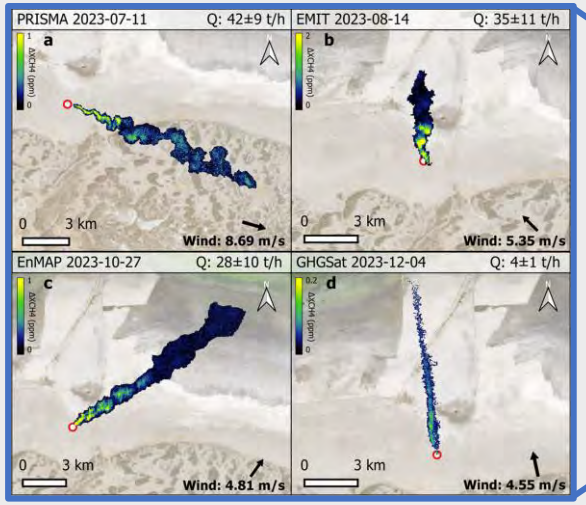
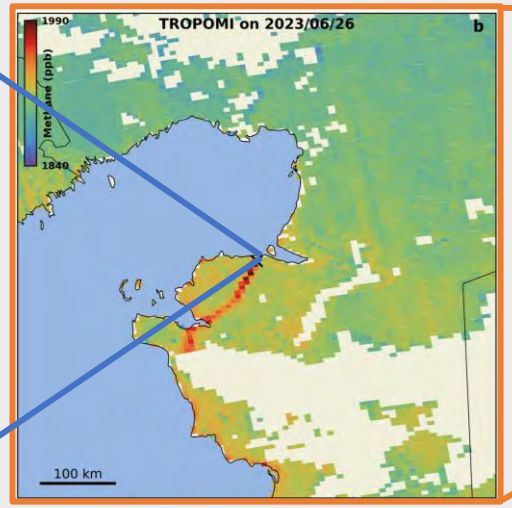


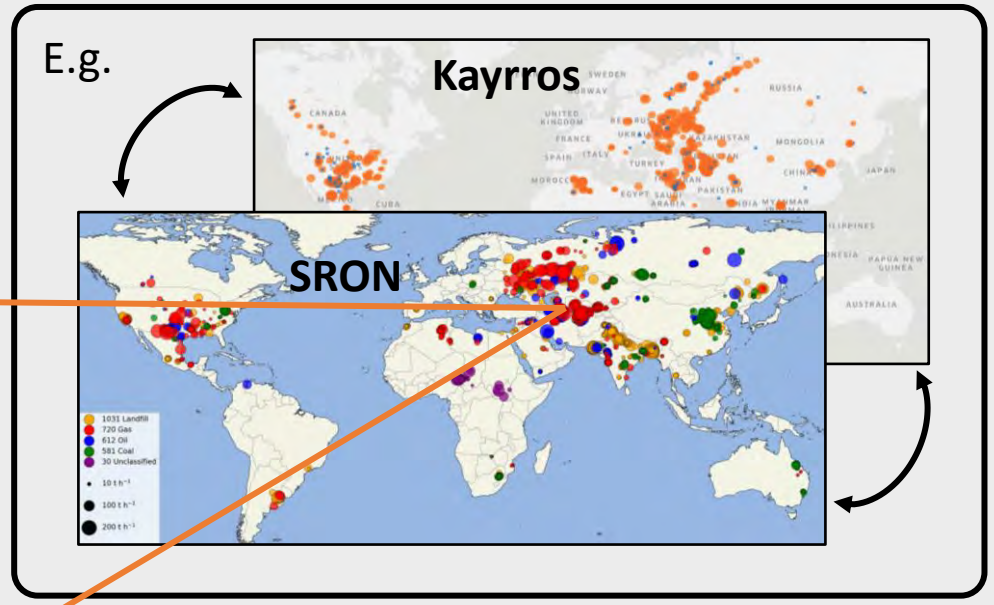
High resolution instruments



Coarse resolution instruments



2 **Intercomparison of different results from similar satellites**



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1 **Validation of emission estimates**

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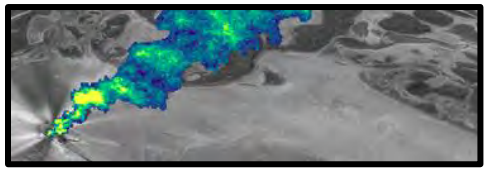
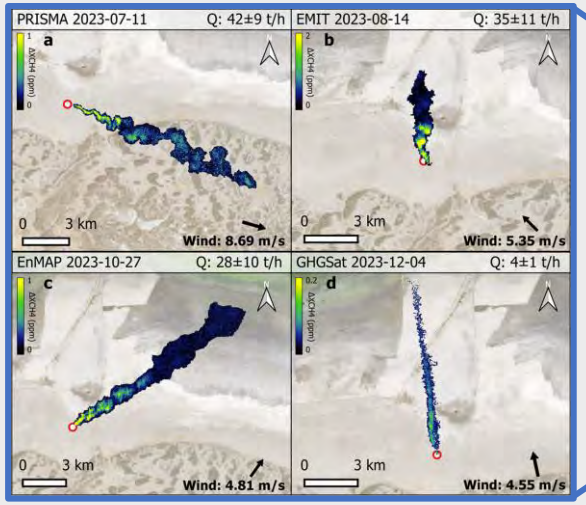


High resolution instruments



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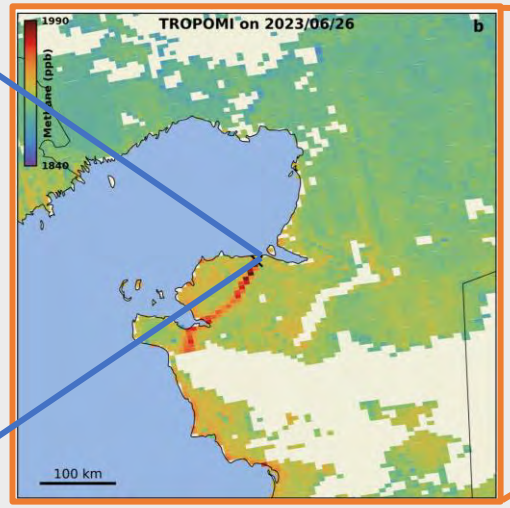
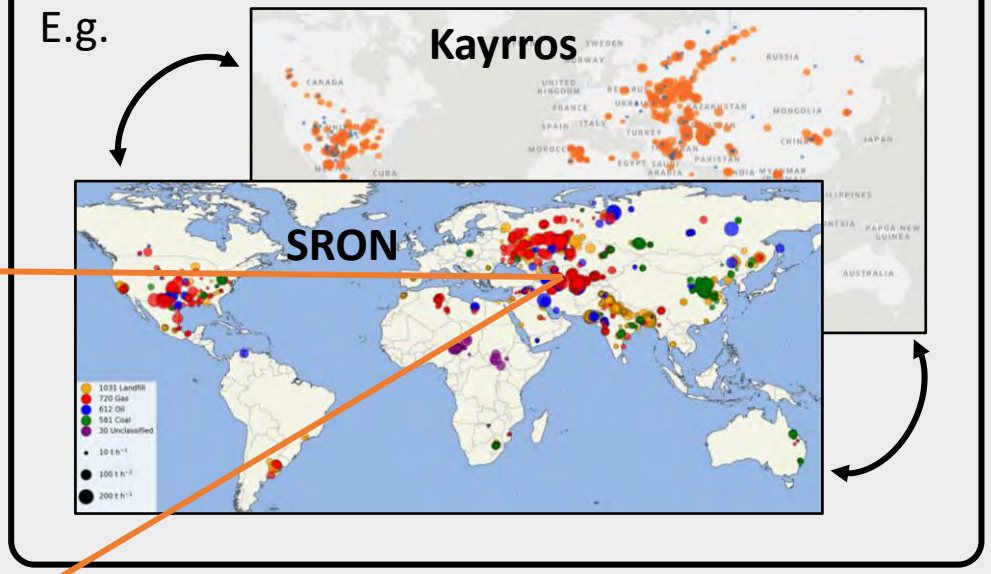


2 Intercomparison of different results from similar satellites

E.g.



1 Validation of emission estimates

Validation of high-resolution imagers against *controlled releases* (gold standard) ..... Linking coarse resolution mapper observations on relevant cases

3 Uncertainty calculation

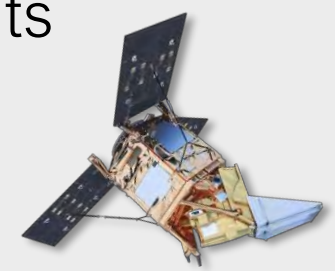
4 Integration and case studies

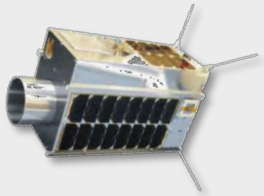
5 High-resolution satellite CO_2 observations

Slide Credit: Matthieu Dogniaux

MEDUSA – Covered instruments

Covered instruments





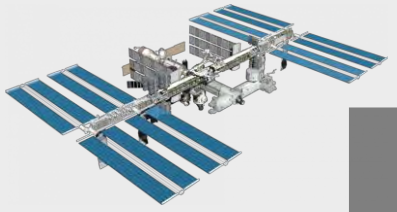
Future data products in gray

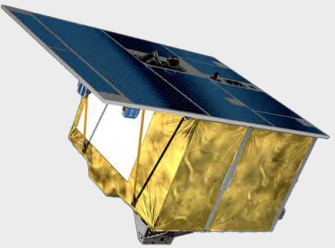
Instrument type	Instrument / Satellite
Flux Mappers	TROPOMI/S5P
	Sentinel-5
	GOSAT-GW
Hyperspectral Imagers	PRISMA
	EnMAP
	EMIT
Band Imagers	Landsat 8
	Sentinel-2
	GOES
	Sentinel-3
	MTG
Methane-specific	GHGSat
	Potentially: Absolute Sensing & Satlantis
Methane-specific instruments (Only using publicly available L4 within MEDUSA)	*Carbon Mapper*
	MethaneSAT

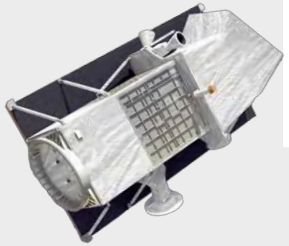
Hyperspectral instruments PRISMA & EnMAP

EnMAP and PRISMA can be targeted with higher priority for specific opportunities such as measurement campaigns, to be arranged with DLR and ASI.

Best to first establish possible opportunities for a certain time window.







	Pixel Resolution (m)	Scene width (km)	Signal-to-noise ratio (SNR)	Spectral Resolution (nm)
EMIT	60	80	~ 500	7.4
EnMAP	30	30	~ 360	10
PRISMA	30	30	~ 180	10

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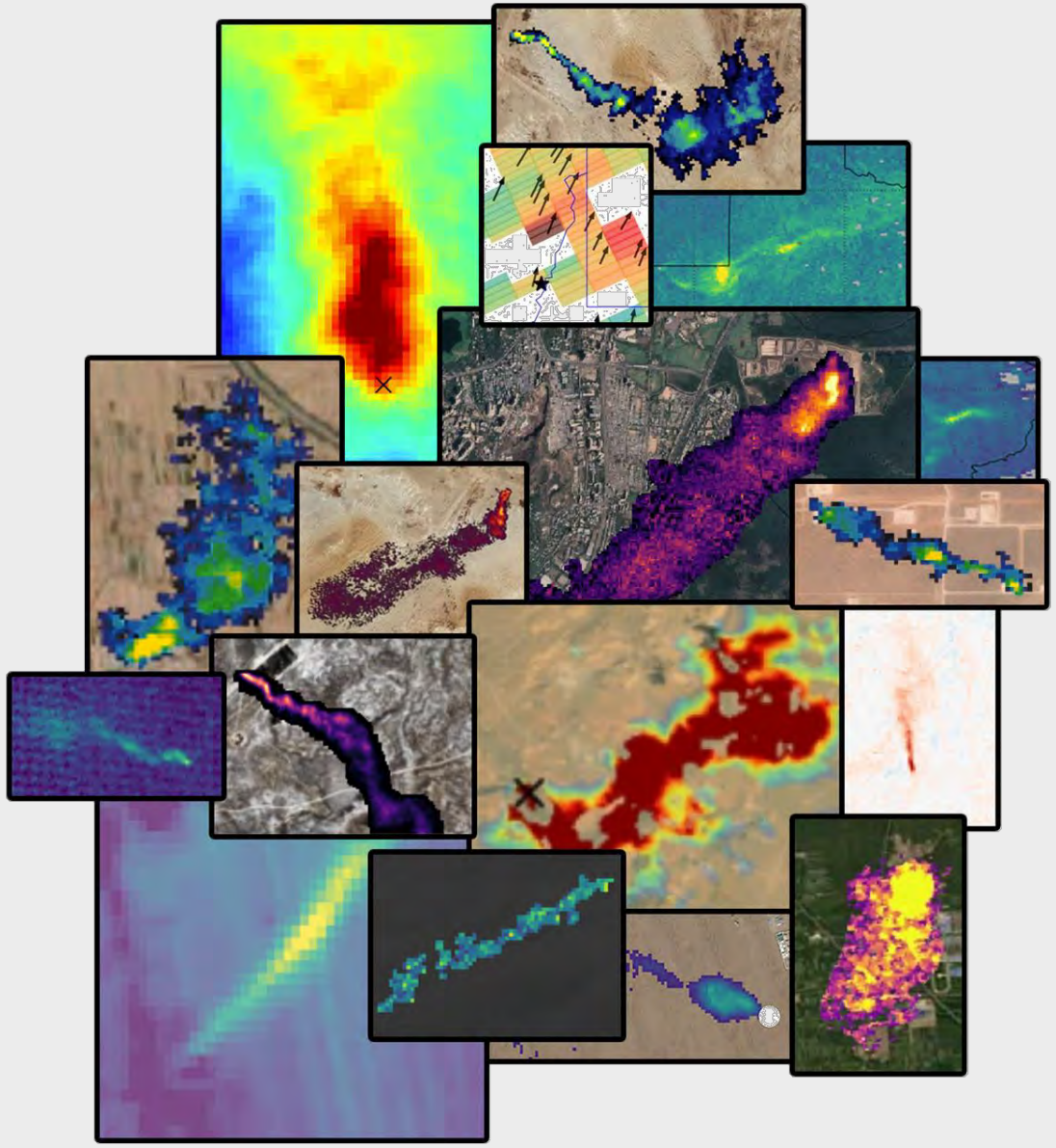

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